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EXAMINER	
FULLER, ERIC B	
ART UNIT	PAPER NUMBER
1762	8

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Applicati n No. 09/715,935	Applicant(s) BI ET AL.	
	Examiner Eric B Fuller	Art Unit 1762	

-- The MAILING DATE f this c mmunicati n appears n the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 February 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *18-61* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *18-61* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 18-29, 33-42, are rejected under 35 U.S.C. 103(a) as being unpatentable over Akedo et al. (US 6,280,802 B1) in view of Bi et al. (US 5,958,348)

Akedo et al. teaches a film forming apparatus that directs a particle stream, which is made up of nanoparticles, towards a substrate and moves the substrate relative to the particle stream in order to coat the substrate (column 3, line 10-12). The input of this apparatus is a continuous stream of particles with a size ranging between 10 nanometers to 5 microns (column 2, lines 41-60). Akedo fails to teach how the particles are produced. However, Bi teaches an apparatus that reacts a reactant stream by directing a focused radiation beam at the reactant stream to produce a product stream comprising particles downstream from the radiation beam, wherein the reaction is driven by energy from the radiation beam (summary). The product stream of this apparatus is a continuous stream of nanoparticles. The benefit over the prior art in using this method in order to produce nanosized particles is the efficient use of resources at high production capacity without sacrificing particle quality (column 2, lines 16-24). Therefore, it would have been obvious at the time the invention was made to a

person having ordinary skill in the art to have the Bi apparatus provide the nanoparticle input of the Akedo apparatus (reference 23, figures 6 and 9). From figures 2, 3, and 4 of Bi, it would have been obvious to perform this in an in-line fashion (having the product stream be directed to the input of the Akedo reference. The motivation to do so would be the reduction of steps. By doing so, one would reap the benefits of the efficient use of resources at high production capacity without sacrificing particle quality. The method that results from this combined apparatus meets all the limitations set forth in applicant's claims 18-29, as will be further discussed.

Bi further teaches that the source of radiation can include a laser (column 1, line 51), as pertinent to claims 19 and 20. Bi also teaches that the reactant stream is elongated in a direction along the propagation of the radiation beam and a line of light propagates to intersect this elongated stream (column 1, line 40-45; column 4, lines 53-60), as pertinent to claims 22, 24, and 26.

Akedo teaches using an electric field gradient to accelerate the product particles towards the substrate (column 2, line 67), as pertinent to claim 29. Akedo further teaches moving the substrate relative to the particle-depositing stream in order to coat the substrate (column 3, lines 10-12). To move the substrate by means of a movable stage, as in a conveyor belt, which is well-known in the art, and pertaining to claims 23 and 24, or to move the entire apparatus over a stationary substrate, as the term "relative to" (line 10) indicates, or to pass the particle stream through on conduit that can sweep over the substrate, as in a hose and nozzle system, which is also well known in the art, and pertaining to claim 28, are obvious variants of each other and it would have been

obvious at the time the invention was made to a person having ordinary skill in the art to perform either of these operations in order to achieve the desired effect of moving the substrate relative to the product stream. When moving the entire apparatus over a stationary substrate, the reactor inlet moves relative to the substrate and the substrate is swept with the particle stream, meeting the limitations set forth in claim 27. Additionally, it also would have been obvious that when one substrate is completely coated, to remove it from the particle stream and to place another, non-coated, substrate in the path of the particle stream, as pertinent to claim 25. Lastly, the examiner takes official notice that pumping is a commonly used and widely known method of transporting gas streams as pressure gradients result in gases being moved. To pump on the reaction chamber to maintain flow though the reaction chamber would have been an obvious way to maintain reactant flow into the reaction chamber.

As to claims 33-38, it has been established previously that it would have been obvious at the time the invention was made to combine these two references. The way they meet the applicant's claimed limitations will be further discussed.

Bi teaches a process where a reactant stream with a cross section perpendicular to the propagation direction characterized by a major and minor axis, the major axis being at least a factor of ten times greater than the minor axis (as shown in the values given in column 4, lines 52-59) and reacting the reactant stream to form a product stream of particles (summary), as pertinent to claim 33 and 36. The radiation can be in the form of a light beam (column 1, line 51), as pertinent to claim 35.

Akedo teaches the process of applying an electric field to accelerate the particles through an optional nozzle onto the substrate (column 4, line 29-32;column 2, line 66). This meets the limitations set forth in claim 33 and also 37. A process of evacuating a chamber to produce a flow into the chamber is also described in column 3, line 35, which can be obviously applied to a substrate chamber and meet limitations set forth in claims 37 and 38. Akedo also teaches that the speed of the particles being applied to the substrate can be as high as 300 m/sec (column 3, line 29). It is known in the art that mass flow-rate is dependent upon velocity, cross sectional area, and density and affects the film thickness that will be deposited. Using these high speeds required of the Akedo reference and the densities that are properties of the particles being produced, it is within the skill of one practicing in the art to adjust the cross sectional area such that the a mass flow-rate is produced that is high enough to sufficiently coat the substrate to a desired thickness and at a desired rate, as pertaining to claim 34.

As to claims 39-42, it has been shown that both references are combined to teach a method of depositing nanoparticles that are produced by laser pyrolysis onto a substrate. How this meets the limitations for this set of claims will be discussed further.

Claim 39 adds in the preamble that the substrate has a diameter greater than 5 cm. However, since the function of the apparatus is not dependant on the shape or size of the substrate, it would have been obvious that the substrate could be flat or spherical and the process would still be performed as taught. Absence criticality, it would have been obvious to use a substrate of such dimensions. Claim 39 also adds the limitation that the particle stream is deposited at a rate of 5 grams per hour. This limitation is

within the skill of one practicing in the art for the cause and effect relationship that is taught above.

Akedo also teaches an electric field that is used to accelerate the particles through a nozzle (column 4, lines 10-15). As the particle speed, which is dependent on the strength of the electric field, increases through the nozzle, the stream will become defocused. This meets the limitations of claims 40 and 41.

Additionally, as one reactant and product stream is sufficient for coating a substrate, it would have been obvious to have multiple reactant and product streams coat a substrate in order to increase deposition rate, as pertinent to claim 42 and 53. *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960).

As to claims 44 and 46, Akedo teaches to produce metal oxide coatings by an oxidation process. Therefore, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use metal precursors in the Akedo and Bi apparatus in order to achieve the metal oxides coatings that are taught by Akedo.

As to claims 47 and 51, Bi teaches the laser emits radiation that may be in the infrared spectrum (column 9, lines 35-40).

As to claim 48, Akedo teaches to move the substrate, this reads on moving the substrate to coat different portions of the substrate.

As to claim 49, Akedo teaches embodiments wherein the product stream is sufficiently wide enough to coat the substrate in one pass (figure 7). Additionally, the product stream of Bi is taught to be wide as well. One skilled in the art, when combining

the two apparatuses, would be motivated to leave the product stream as it is when leaving Bi, rather than to converge it into a smaller stream. The energy beam of Akedo would therefore be applied by the same means as it is applied in Bi.

As to claim 50, to use 25 grams per hour as the deposition rate would have been obvious and within the skill of one practicing in the art due to the same cause-and-effect relationship for the obviousness in using 5 grams per hour as explained above.

As to claims 55-57, 59, and 60, these claims are rejected to for reasons given above as they only contain limitations that have been previously addressed.

As to claim 61, it is the examiner's position that since Akedo does not teach that the substrate is porous, that it reads on not permitting gas to pass through it.

Claim 30, 43, 45, 52, and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lehman (US 6,097,144) in view of Akedo et al. (US 6,280,802 B1) and Bi et al. (5,958,348) in further view of Kambe et al. (WO 99/23189).

Lehman teaches a process of producing a glass coating that involves applying frit to a cold or heated substrate. The process is performed by mixing the frit, having a 200-325 mesh size, with a carrier solvent and the spraying the coating to the surface (column 5, lines 50-67). If the substrate is cold, a series of heating and cooling steps are performed in order to melt, fuse, and anneal the glass coating (column 6, lines 1-20). Lehman fails to use the method of applicant's claim 18 to apply the glass coating. However, Bi teaches that nanoparticles exhibit exploitable chemical and mechanical properties that are different from larger sized particles (background), and that the taught

apparatus is advantageous to use in order to produce these nanoparticles due to its efficient use of resources (column 2, lines 17-25). An additional obvious benefit of having the particles be of a smaller size would be the ability to form thinner, or more uniform, films of glass. The Bi and Akedo references can be combined as taught previously in order to produce coatings by nanoparticles, and therefore it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use the method taught by Bi and Akedo in order to apply the glass coating of the Lehman process in order to reap the benefits of a thinner, or more uniform, coating. Additionally, the combined process would be more efficient as a carrier solvent would no longer be required. The Kambe reference is used in order to establish that the combined Bi and Akedo apparatus is capable of producing glass particles. Kambe teaches a similar apparatus as Bi, as nanoparticles are produced by laser irradiation. The differences between Kambe and Bi are in the process that the particles perform after they are produced, and not in how they are produced. The nanoparticles produced in the Kambe apparatus is silica (abstract), which can be used for producing glass. It would have been obvious from the Kambe reference that the apparatus taught by Bi would also be able to produce silica nanoparticles. Furthermore, it would have been obvious that the combined Akedo and Bi apparatus is able to produce silica coatings as well, as column 5, first paragraph of the Akedo reference teaches that the apparatus taught is capable of producing oxide films.

In performing this process, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use a silicon precursor in order to achieve silicon oxide as the product stream.

Claims 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al. (US 6,074,888) in view of Lehman (US 6,097,144), and further in view of Akedo et al. (US 6,280,802 B1) and Bi et al. (US 5,958,348) in view of Kambe et al. (WO 99/23189).

Tran teaches that in order to produce an optical component, it is required to produce an optical component layer (abstract, summary), which is typically glass. Then photolithography is used to fabricate the optical component (column 3, line 59). Tran fails to teach applying the coating by the method taught by applicant's claim 18. However, it has been shown that the Lehman, Akedo, Bi, and Kambe references can all be combined to teach a method of producing a glass coating that has the advantages of being more uniform, is capable of being thinner, and does not require a solvent. To use this method of forming a glass coating when producing the optical layer taught in the Tran reference would have been obvious at the time the invention was made to a person having ordinary skill in the art in order to reap the benefits of a thinner, more uniform, coatings without the need for a solvent.

Claims 18-29, 39-41, 50, and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Börner et al. (US 6,032,871) in view of Bi et al. (US 5,958,348).

Börner teaches a process of spraying two different materials to a substrate by applying differing charges to each particle stream (figure 3). Börner is silent to how these particle streams are produced. However, Bi teaches that nanoparticles exhibit exploitable chemical and mechanical properties that are different from larger sized particles, such as increased smoothness and thinner coatings (background). The apparatus taught by Bi is advantageous to use in order to produce these nanoparticles due to its efficient use of resources (column 2, lines 17-25). Therefore, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use the apparatus of Bi to produce the particle streams of Börner. By doing so, one would reap the benefits of having an efficient way of producing nano-sized particles such that a smoother and/or thinner coating is achieved. This meets the limitations of claim 18.

As shown above, the limitations of claims 19-22, 26, 39, 50, and 51 are taught by Bi and therefore are rejected to for the same reasons.

As to claims 23, 27, and 28, Börner is silent in having relative motion between the substrate and the particle stream. However, one skilled in the art, after viewing figure 3, would recognize that relative motion would be required in order to coat the entire substrate. To have the substrate mounted to a movable stage or to have the particle stream be swept over the substrate (either by moving the entire apparatus or to have a conduit apply a sweeping motion to the stream) are all well known methods of applying a coating to a substrate, that are also obvious variants of each other as well.

As to claims 24 and 25, Bi teaches the limitations of these claims, as explained above.

As to claims 29, 40, and 41, Börner teaches to charge the particle streams, which can be applied simultaneously (figure 2). This would produce an electric field between the two streams that causes defocusing of the streams and directs the streams to the substrate (column 2, lines 30-65).

Claims 53 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Börner et al. (US 6,032,871) in view of Akedo et al (US 6,280,802) and Bi et al. (US 5,958,348).

Börner teaches the desire to have powder coatings of two different materials applied to the same substrate by means of two differently charged particle streams. Akedo and Bi, combined, teach a materially efficient method of producing charged particle streams that have the benefit of being nano-sized, which results in thinner and/or smoother coatings, as explained above. Therefore, it would have been obvious to use the method and apparatus of Akedo and Bi to provide the particle streams of Börner. By doing so, one would reap the benefits of an efficient way to produce smoother and/or thinner coatings. By figure 3 of Börner, one in the art would be motivated, when combing the three references, to have a separate "Akedo and Bi" apparatus provide each stream. This is because the streams of figure 3 are coming from separate sources.

R sponse to Arguments

Applicant argues that the Akedo reference does not teach that the particles are produced by the radiation, as the claims have been amended to read. Examiner agrees and has withdrawn the previously made 35 USC 102(e) and 103(a) rejections over Akedo et al.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988), and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). Specifically, applicant argues that there is no motivation to combine Akedo and Bi, since Akedo does not teach that the particles are produced in-situ because they are taught to be from an aerolizing chamber. This is not found persuasive. Not all the embodiments of Akedo require the use of the aerolizing chamber, such as figures 6, 8, and 9, which only requires a particle stream input without specifying where it is from. It would have been the motivation of one practicing in the art to provide this particle stream input in an efficient manner. Bi teaches a process that produces a particle stream that has the benefits of efficiently using resources at a high production capacity without sacrificing particle quality. Therefore, to use Bi would have been obvious. The motivation to use Bi in such a way that it is in-line would be the reduction in steps of having to collect the particles and

transfer them to the Akedo apparatus. It would have been obvious that it is possible to have the apparatus perform in-line since the product stream of figures 2-4 of Bi fit the requirements of the input stream required in figures 6, 8, and 9 of Akedo.

Applicant argues that the benefits of Bi would only be present for processes that involve collecting the particles and not depositing them. This is found unpersuasive. It is the examiner's position that since the particles are produced upstream from the collector, the presence or absence of the collector would have no effect on the efficiency of the process. Furthermore, the collector itself is technically a substrate. Therefore, to argue that providing a substrate in place of the collector reduces the efficiency of the process is not found to be persuasive.

Applicant argues that there is no reasonable expectation of success. This is not found to be persuasive. Akedo requires an input stream of nano-sized particles (figures 6, 8, and 9). Bi produces a stream of nano-sized partices (figures 2, 3, and 4). One skilled in the art would have a reasonable expectation of achieving a coating on a substrate when using the product stream of Bi as the inlet for Akedo since Bi is providing the stream that fulfills Akedo's requirements.

Applicant argues that since Lehman requires the use of a carrier solvent, that it would not have been obvious to combine the reference with the teachings of Akedo, Bi and Kambe. However, Kambe, Bi, and Akedo, are sufficient alone in teaching that the Akedo and Bi apparatus is capable of producing uniform glass coatings. Lehman, the primary reference, teaches the need for producing a uniform glass coating. Therefore, to produce the glass coatings of Lehman by the method of Akedo, Bi and Kambe, would

have been obvious to one of ordinary skill. Lehman requiring a solvent provides additional motivation (over that which was addressed in the previous action) to use the Akedo and Bi apparatus to produce a glass coating. By doing so, not only is the resulting film more uniform, but also the use of a solvent is not needed.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). The reconstruction is as follows: One skilled in the art would recognize that the apparatuses of Kambe and Bi are nearly identical in how they produce the nano-sized particles. To combine these two references would have been obvious. By combining the two references, it is known that the Bi apparatus can be used to produce silica. The motivation to combine Bi with Akedo is that the Akedo requires an input of nanoparticle and Bi produces nanoparticles in an efficient manner than does not sacrifice particle quality. Lehman, the primary reference, teaches the need for a uniform glass coating. Bi, Akedo, and Kambe teach a method of producing a uniform glass coating. Therefore, to use the Bi, Akedo, and Kambe method to provide the uniform glass coating of Lehman would have been obvious at the time the invention was made to a person

having ordinary skill in the art. An additional benefit of this process would be that solvent would not be required.

Applicant argues that the Tran reference, used to reject claims that depend on claim 30, does not make up for the deficiencies of the Lehman, Bi, Akedo, and Kambe references in rejecting claim 30. However, it is the examiner's position, as shown above, the there are no deficiencies in the four references in meeting all the limitations of claim 30.

All other arguments pertain to one not being motivated to combine Akedo and Bi. However, these arguments are unpersuasive for the reasons stated above.

Conclusion

Applicant's amendment, to overcome the previous 35 USC 102(e) rejection over Akedo et al. (US 6,280,802), necessitated the additional new grounds of rejection presented in this Office action for claims 18-29 and 39-41. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B Fuller whose telephone number is (703) 308-6544. The examiner can normally be reached on Tuesday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

EBF
April 17, 2002

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